



Technical Assistance Services for Communities

West Lake Landfill Superfund Site Fact Sheet – November 2015

Baseline Human Health Risk Assessment

Introduction

EPA listed West Lake Landfill on the Superfund program's National Priorities List in 1990. To manage the cleanup, EPA divided the 200-acre area into two areas, or operable units (OUs). OU1 addresses radiologically contaminated areas – Areas 1 and 2. OU2 addresses other landfill areas, including the Bridgeton Sanitary Landfill. See Figure 1.

The responsible parties completed and EPA approved a Baseline Human Health Risk Assessment

(BHHRA) for OU1 in 2000. The BHHRA identified several contaminants of potential concern:

- Eight radionuclides (uranium-238, -235 and -232, thorium-232 and -230, radium-226, lead-210, and protactinium-231).
- Three trace metals (arsenic, lead and uranium as a metal).
- One polychlorinated biphenyl (Aroclor 1254).

This fact sheet provides information on BHHRA and briefly discusses the 2000 BHHRA for OU1. The 2000 BHHRA for OU1 helped EPA determine the need for remediation of OU1. The BHHRA does not cover areas of OU2 under EPA or Missouri Department of Natural Resources (MDNR)

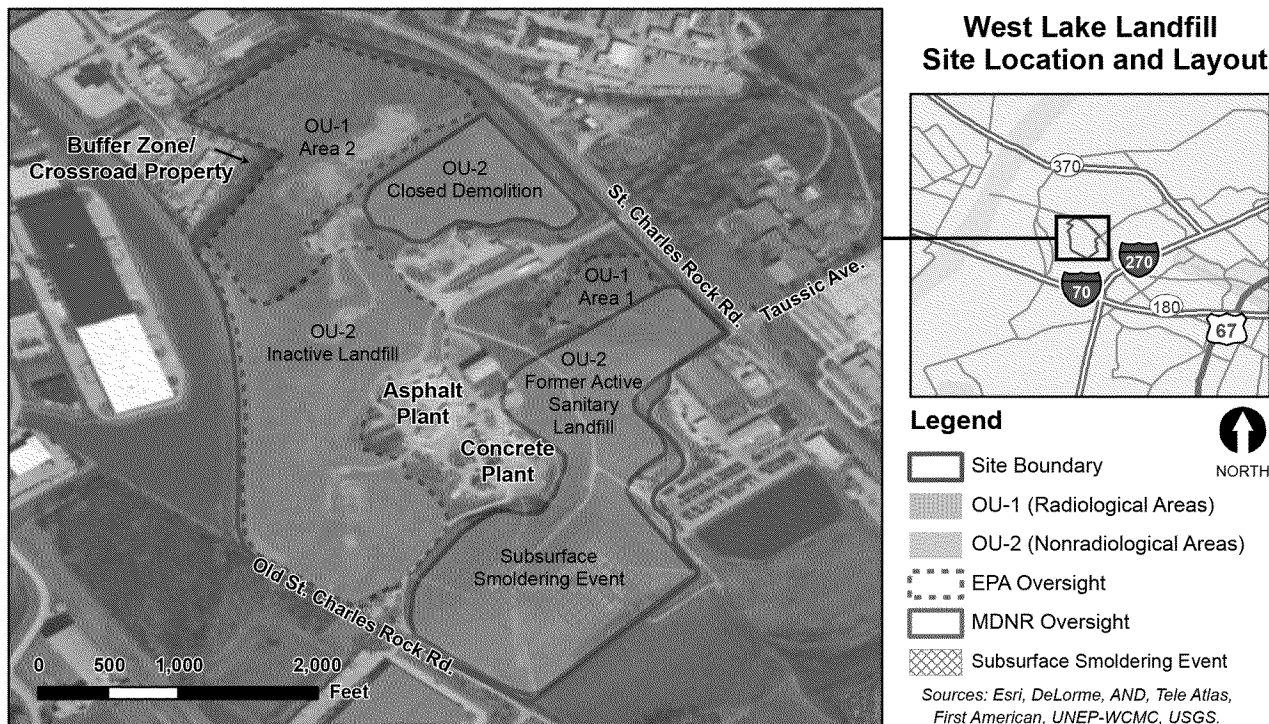


Figure 1. West Lake Landfill (location of subsurface smoldering event is not up to date)

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oversight.

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What Is the Purpose of a BHHRA?

A BHHRA helps people understand potential risks to human health from exposure to contaminants found at a Superfund site (OU1 at West Lake Landfill in this case) and supports site decision making. If any new significant information is discovered, the BHHRA can be updated. Site-specific cleanup levels at Superfund sites are set based on the results of the BHHRA, in order to protect human health.

How Is a BHHRA Performed?

There are four steps to a BHHRA.

1. Hazard identification
2. Exposure assessment
3. Dose-response assessment
4. Risk characterization

1. Data Evaluation takes place during the remedial investigation at a Superfund site. The investigation identifies the contaminants present and their locations and concentrations. A remedial investigation for OU1 finished in April 2000. Due to community concerns, additional sampling and investigation is currently taking place.

2. Exposure assessment also takes place during the remedial investigation. Exposure assessment includes determining where exposure could happen and who could be exposed to site contaminants, both now and in the future. A conceptual model identifies all possible pathways by which a person could be exposed. Exposure pathways include how and where people could come in contact with contaminated soil, water or air, such as through accidental ingestion of contaminated soil or water, or by breathing contaminated air.

If contaminants have migrated off site in soil, air or groundwater, these possible exposure pathways are also investigated. For example, if surface soil is contaminated and could have been carried off site in rainwater, the runoff is investigated. At West Lake Landfill, exposure assessment also includes the potential for exposure to penetrating radiation from gamma-emitting radionuclides.

The exposure assessment in the 2000 BHHRA for OU1 first considered these potential exposure pathways:

- Current Exposures (2000)
 - Supervised remediation workers within OU1.
 - Groundskeepers who perform grounds maintenance three times per year in areas of West Lake Landfill next to OU1.
 - Office workers in a building about 50 feet north of Area 1, within OU1. See Figure 1.
 - Trespassers, groundskeepers and storage yard workers on property surrounding West Lake Landfill, including the Ford property.
- Future Exposures
 - Recreational users, trespassers or on-site workers such as groundskeepers, workers in adjacent buildings who traverse Areas 1 and 2 when entering and leaving, and workers using OU1 as an outdoor storage yard.

Exposure to off-site populations was not evaluated in the BHHRA because the current and future exposures listed above are greater due to the proximity of these individuals to the contaminants and the duration of the exposure. To mitigate risk for the individuals listed above would also mitigate risk for off-site populations.

After initial evaluation, the following exposure pathways were determined to be complete and risk calculations were made:

- Current Exposures
 - Groundskeepers who perform grounds maintenance three times per year in areas of West Lake Landfill next to OU1.
 - Groundskeepers for the Ford property who perform maintenance one day per week, 26 weeks per year.
- Future Exposures
 - Groundskeepers for Areas 1 and 2 of OU2 who perform grounds maintenance three times per year.
 - Building user adjacent to Areas 1 and 2 of OU1 who uses portions of Areas 1 and 2 for

parking and is exposed only to gamma radiation from beneath a paved or gravel parking lot in Areas 1 and 2.

- Outdoor storage yard worker who works seven hours per day in a building next to Areas 1 and 2 and who works for one hour per day outdoors on the paved or graveled area on Areas 1 and 2 and is exposed only to gamma radiation from beneath a paved or gravel parking lot in Areas 1 and 2.
- Groundskeepers for the Ford property who perform maintenance one day per week.

The 2000 BHHRA for OU1 eliminated the current exposure pathway for office workers in a building about 50 feet north of Area 1, within OU1, from further consideration. This was because the only exposure route was inhalation of re-suspended dust or radon. Negative results for air monitoring data and indoor radon measurement data collected by the landfill operator indicated that this was not a complete exposure pathway.

For both current and future scenarios, the groundskeeper and trespasser scenarios were considered similar exposures, with the groundskeeper scenarios including longer periods of exposure. Therefore, only the groundskeeper scenarios were included in risk calculations because these scenarios result in higher exposure levels than the trespasser scenarios.

Exposure point concentrations are the concentrations of contaminants used in risk calculations for each exposure scenario. Table 1 shows the current exposure point concentrations in Area 2 soil used in the 2000 BHHRA for OU1 (adapted from Table A.3-3 of the 2000 BHHRA). Different values were used for Area 1 and the Ford Property based on soil samples from those areas.

3. Dose-response assessment takes place separately from site-specific investigations. This assessment estimates the relationship between the amount of exposure to a substance and the potential health effect. Scientists base dose-response determinations on animal studies, limited human health data and

assumptions about long-term exposure. Any human health data usually comes from industrial accidents or other types of accidental human exposures that provide information about the health effects of different substances. State and federal regulations limiting the amounts or concentrations of contaminants in soil, water and air at the point of exposure are typically based on dose-response assessments.

**Table 1: Current Exposure Point Concentrations for Area 2
95% UCL on the Arithmetic Mean***

Contaminant	Surface Soil	All Soil Depths	Units
<i>Uranium Series</i>			
U-238 + 2 daughters	83.5	27.1	pCi/g
U-234	156	46.0	pCi/g
Th-230	8,920	3,730	pCi/g
Ra-226 + 5 daughters	1,130	338	pCi/g
Lead-210 + 2 daughters	384	128	pCi/g
<i>Actinium Series</i>			
U-235 + 1 daughter	5.99	1.83	pCi/g
Pa + 8 daughters	559	162	pCi/g
<i>Thorium Series</i>			
Th-232 + 10 daughters	36.6	15.9	pCi/g
<i>Inorganic Chemicals</i>			
Arsenic	15.9	NE **	mg/kg
Lead	1,176	NE	mg/kg
Uranium	250	NE	mg/kg
<i>Organic Chemicals</i>			
Aroclor-1254	1.02	NE	mg/kg

* See August 2015 TASC fact sheet on 95% UCL.
** "NE" = no exposure. The exposed person is not exposed to subsurface soil.
pCi/g = picocuries per gram of soil
mg/kg = milligrams per kilogram of soil

Noncancer health effects are measured by the hazard index (HI). The HI is the sum of the hazard quotients (HQs) for each contaminant of concern included in the risk assessment. If the HQ for a substance that a person is expected to be exposed to at a Superfund site is less than 1, no adverse health effect is expected from that substance. The HQ is calculated by dividing the concentration or amount of substance a person could be exposed to by a reference dose (RfD) or reference concentration (RfC). The RfD is the daily oral exposure not likely to cause adverse noncancer health effects in humans, usually including sensitive subgroups, such as children and pregnant women, over a lifetime of exposure. The RfC is the concentration in air where continuous inhalation is not likely to cause adverse noncancer health effects over a lifetime of exposure. If the sum of the HQs or the HI at a Superfund site is greater than 1, EPA generally requires further action.

Cancer health effects are calculated differently than noncancer health effects. The BHHRA assumes that any exposure results in increased risk of developing cancer. Cancer risk is expressed as the extra lifetime risk of cancer due to contaminant exposure. It is expressed with numerical values. A cancer risk of $1\text{E-}04$ or 1×10^{-4} means an extra lifetime cancer risk of 1 in 10,000. A cancer risk of $1\text{E-}06$ or 1×10^{-6} means an extra lifetime cancer risk of 1 in a million. If the extra lifetime cancer risk is 1 in a million or less, EPA does not generally require cleanup at a Superfund site. If the extra lifetime cancer risk is greater than 1 in 10,000, EPA generally requires further action to reduce the risk. For cancer risk between 1 in 10,000 and 1 in a million, EPA makes cleanup decisions on a site-by-site basis.

4. Risk characterization is a calculation of the human health risk associated with the identified contaminants at a Superfund site. The calculation is based on combining information from the first three steps of the risk assessment – data evaluation,

exposure assessment and toxicity assessment. It is also based on assumptions about the behavior of people who may be exposed. For example, the 2000 BHHRA assumed that a groundskeeper would accidentally ingest 100 milligrams of soil per day. This amount of soil, the contaminant concentration in the soil, and the number of days a person is exposed are the values used in the calculation of risk for the groundskeeper. In addition, characterizing risk involves discussing uncertainties associated with each step of the risk assessment process. The 2000 BHHRA for OU1 contains the calculation formulas used to calculate risk.

Summary

A BHHRA evaluates human health risk associated with contaminants found in soil, water and air at a Superfund site. Risk is calculated for all potentially completed exposure pathways. If site-related contaminants are found off site and are above EPA screening levels, off-site exposure pathways are considered and off-site risks are calculated for all potentially complete pathways.

The 2000 BHHRA for OU1 concluded that the HI for all current and future exposure scenarios was less than 1. This means that no adverse noncancer health effects are expected from site-related contaminants identified for inclusion in the BHHRA.

The 2000 BHHRA for OU1 also concluded that cancer risk for current exposure scenarios was within the EPA's target risk range of 1 in 10,000 to 1 in a million excess lifetime cancer risk. The maximum cancer risk was to groundskeepers working next to Area 2. An excess lifetime cancer risk of 4 in 100,000 was calculated for the groundskeeper.

The groundskeeper, the adjacent building user, the storage yard worker for Areas 1 and 2, and the Ford property groundskeeper were evaluated under projected future conditions (exposure to gamma radiation from below a graveled or paved parking lot). The evaluation indicated that the cancer risk to a future groundskeeper on the Ford property falls within the EPA's target risk range. However, workers accessing Areas 1 and 2 in the future have

potential excess lifetime cancer risks greater than 1 in 10,000. The greatest risk was to storage yard workers in Area 2 with a calculated excess lifetime cancer risk of 4 in 10,000. Currently, access to Areas 1 and 2 is limited, and on-site workers are monitored for radiation exposure.

Other Types of Risk

A BHHRA does not address other types of risk, such as earthquakes, flooding, fire or other natural disasters that could cause additional releases of contaminants or failure of a remedy. These types of risks are considered during the design phase of a remedy. Remedy design reviews take place as the design progresses to evaluate and mitigate design-related risks. Formal reviews typically take place at 30 percent, 60 percent and 90 percent of design completion.

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